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NITROUS OXIDE SYSTEM (NOS) IN AUTOMOBILES

BAISHAKHI BEHERA & MANISH BEHERA

Department of Mechanical Engineering, College of Engineering & Technology, Bhubaneswar, Odisha, India

ABSTRACT

This Research Paper aims at analyzing the performance enhancement of automobiles by increasing the combustion efficiency of the engine. The mode used is application of Nitrous Oxide gas. The key to combustion efficiency of an engine is amount of oxygen content and full-fledged burning of the air-fuel mixture. Nitrous oxide precisely provides these two essences by supplying more oxygen and thus supplements the combustion potential of the engine. The paper also makes an attempt to give a comparative study of a normal engine and an engine with nitrous oxide system.

KEYWORDS : Nitrous Oxide System (NOS), Nitrous, Combustion Efficiency

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Original Article

INTRODUCTION

The improvement in performance of an engine has always been the hotspot in Vehicle Research and Development sector. The factors that mainly impacts an engine performance are the efficiency of combustion of air-fuel mixture, type of air-fuel mixture-lean or rich used, aim of the usage as in- high speed functioning or fuel economy, detonation/ignition delay, type of injection-naturally aspirated or supercharging and engine design.

Of all the above, here we will discuss about increasing the combustion potential of the engine. For higher horse power, key is combustion of more fuel and the main ingredient to combustion is availability of oxygen. It is noteworthy that oxygen content in the injected air is about 20% by weight. Thus method has to be devised to increase this oxygen content without any revolutionary change to engine set up. The answer is use of Nitrous oxide (N_2O).

N_2O is a colorless, non-flammable gas with a pleasant slightly sweet odor at room temperature. It is a cryogenic gas composed of two molecules of nitrogen and one molecule of oxygen.

CHEMICAL ANALYSIS OF NITROUS OXIDE (N_2O)

At a temperature of about 576 degree F, Nitrous oxide breaks down to oxygen and nitrogen involving an exothermic reaction. This breaking down increases the oxygen content in the system to about 36% by weight. The governing chemical equation is as follows:

$$2N_2O\,(g) \longrightarrow N_2\,(g) + O_2\,(g) + \text{heat} \quad (1)$$

The property of Nitrous oxide is enlisted below.

Table 1

Color	Colorless
Odor	Slightly Sweet
Melting Point	-90.81degree Celsius
Boiling Point	-88.46degree Celsius
Density	1.799g/l at NTP
Density of N_2O: Air	1.52:1.00
Solubility	Very soluble in alcohol, ethers and Sulfuric acid
Molar Mass	44.0128g/mol

Thus this increased amount of oxygen increases the combustion potential of the engine

Table 2

Element	% of O_2 by Weight
Air	20
Nitrous oxide	36

NITROUS OXIDE SYSTEM

Nitrous Oxide System (NOS) is the module that is installed in the vehicle to get higher Horse Power. It includes a cylinder where N_2O is stored in liquefied form, an electric fuel pump to supply additional fuel, two closed solenoid valve (one for N_2O cylinder and other for electric fuel pump) to regulate the nitrous and fuel injection into the inlet manifold of the engine, fogger nozzles to inject nitrous at high velocity and delivery pipe for carrying fuel and nitrous to engine. The solenoid valves are actuated by means of throttle or manually activated arm switch.

The schematic diagram of a Nitrous Oxide System is given below:

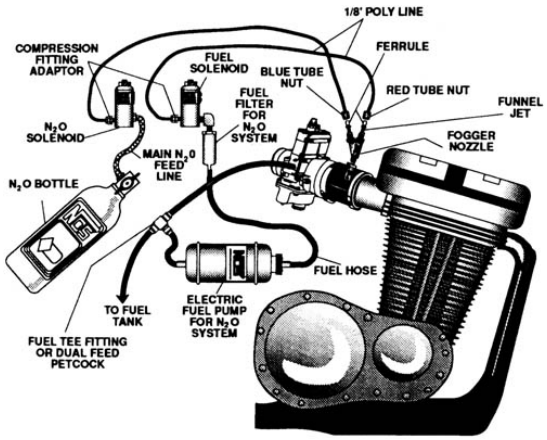

Figure 1

WORKING PRINCIPLE of NOS

Nitrous oxide which exists in gaseous state at room temperature is stored in the cylinder in liquefied form under pressure. On activation of throttle or manually operated arming switch, the solenoid valves opens and nitrous passes through it and injected into the inlet manifold of the engine by fogger nozzles via delivery pipe. Similarly fuel from electric fuel pump is injected into the inlet manifold of the engine. This fuel is tapped from the main fuel line by means of 'T' as shown in above schematic diagram.

During compression stage at a temperature of about 576 degree F, the liquefied nitrous decomposes to oxygen and nitrogen. This additional oxygen helps in combustion of more fuel and thus enhances engine's Horse Power.

By burning more fuel, higher pressure is created and this is where increased power output is realized. Also, boiling of nitrous causes change of state from liquid to gas resulting in reduced engine temperature which plays an important factor in achieving higher output. This cooling effect reduces the temperature to about 60-75 degree F.

Injection of nitrous also increases the breathing capacity of the engine, i.e. volumetric efficiency resulting in increased output.

CLASSIFICATION of NOS

Based on type of injection of nitrous and additional fuel into the inlet manifold of the engine, NOS can be classified into two types:

- Dry System
- Wet System

Dry System refers to discrete injection of nitrous and fuel into the inlet manifold. Here the NOS only supplies Nitrous while fuel is supplied by the conventional fuel injector. This system relies on single type nozzle that sprays only nitrous in 90 degree pattern. The schematic layout is shown below:

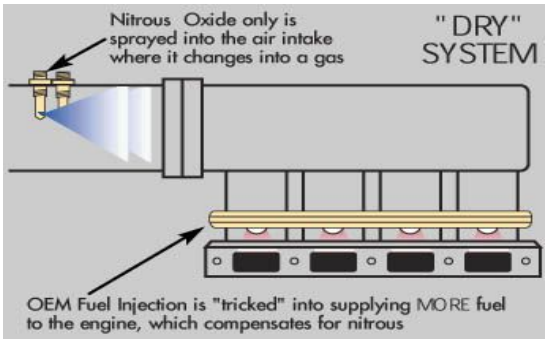

Figure 2

Wet system refers to the composite injection of nitrous and fuel by the same fogger nozzle. The advantage of this type is that fuel and nitrous quantities are metered before they are injected. This ensures proper atomization of nitrous and fuel giving consistent power gains. The schematic diagram is shown below:

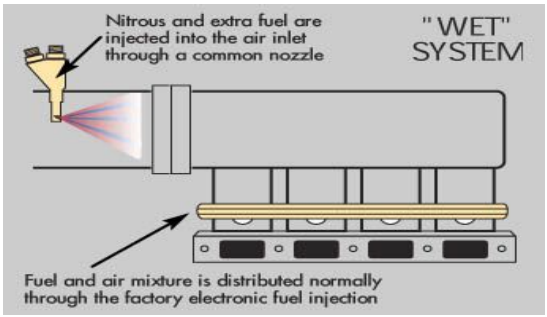

Figure 3

On the basis of type of introduction/use of fogger nozzle, wet system is further subdivided into:

- Single Port type
- Direct Port type
- Plenum bar type

Single port type consists of only one fogger nozzle for injection into the engine cylinder. Direct port type involves direct introduction without any valve actuation. Plenum Bar type consists of spray bars installed inside the plenum of inlet manifold. These are used in conjunction with direct port type in multi-cylinder engines. The plenum bar type is illustrated below by the help of a schematic diagram:

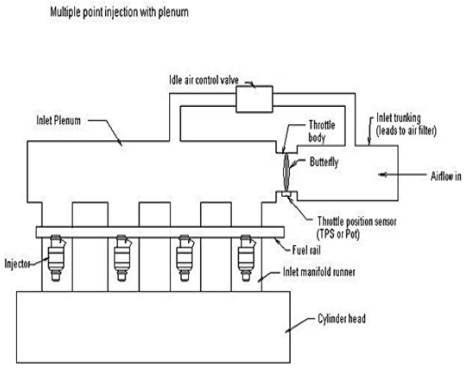

Figure 4

DETONATION MITIGATION

With high pressure, more combustion, there is increased potential of detonation. For this, the decomposed nitrogen plays a mitigating role by suppressing detonation. But with higher heat generation, more amount of fuel has to be introduced to produce an increased cooling effect to prevent detonation.

Thus, Nitrous Oxide System is provided with a rich jetting to give a safe starting point. Although, rich jetting will mean reduction of power output slightly but the increased detonation limit will allow usage of more nitrous to produce power safely.

CONCLUSIONS

Thus, NOS is a very efficient means of achieving higher speed and power. It's a regular in the world of racing. With more amount of research, it's bound to become a regular in our near future. A proper combination of air-fuel ratio, engine design and application of NOS surely proves to be the ingredients of enhanced power.

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AUTHOR DETAILS

Baishakhi Behera is currently pursuing B.Tech Degree in Mechanical Engineering from College of Engineering and Technology (BPUT), Bhubaneswar, Odisha, India. She is currently the member of American Society of Mechanical Engineers (ASME) and Society of Automotive Engineers (SAE). She is serving as the General Secretary of ASMECET BHUBANESWAR CHAPTER. She represented the

Team "The Gutsy Gladiators" that won 7th rank in innovation event of ASME HPVC INDIA 2016 held in Vellore Institute of Technology. She is also a certified SIX SIGMA YELLOW BELT PROFFESSIONAL.

Manish Behera is currently pursuing B.Tech Degree in Mechanical Engineering from College of Engineering and Technology (BPUT), Bhubaneswar, Odisha, India. He is currently the member of American Society of Mechanical Engineering (ASME). He is serving as the Head of Operations of ASME CET BHUBANESWAR CHAPTER.

He is also the vice-captain of the team "The Gutsy

Gladiators" that won 7th rank in innovation event of ASME HPVC INDIA 2016 held in Vellore Institute of Technology. He is also a certified SIX SIGMA GREEN BELT PROFFESSIONAL.